

Changes to the Definitions and Nomenclature Found in the Design Intent Tool

Draft 1, 10/6/99

These new definitions modify those found in Version 1.01.06, file dit6.mdb.

Primary changes:

1. Change "Performance Objective" to "Design Concept."
2. Change "Design Intent Document" to "Design Intent Narrative."
3. General clarification of the concepts and process.
4. Examples

Draft 2 12/15/99

Changed all definitions and descriptions per the 10/~7/99 conference call.

These new definitions modify those found in Version 1.01.11, file dit11.mdb.

Outline in "Components of Design Intent" Page

Design Intent

Design Intent Document

Design Intent Narrative

Design Basis

Design Objectives

Design Concepts

Performance Metrics

Assessment Record

Design Intent Process

Maintaining and Modifying Design Intent

Design Intent

There is not a standard definition of design intent. The Model Commissioning Plan and Guide Specifications developed by Portland Energy Conservation, Inc. (PECI) for the U.S. Department of Energy provides a useful starting point for defining design intent. The PECI guide describes design intent as a dynamic statement that explains the ideas, concepts, and performance criteria that are considered to be of high importance to the facility owner (PECI/USDOE, 1997). It is initially the outcome of traditional programming and conceptual design phases.

Design intent is defined within the context of this tool as: clear and concise statements listing design objectives for a building, and the specific design concepts, standards and criteria used to evaluate the achievement of these objectives. The Design Intent is an archive of a building's expected and achieved space and system performance over the building's life.

A general reference to "design intent" in this tool, is referring to one or more parts of the Design Intent Document, which holds all current design intent information.

Design Intent Document

The Design Intent Document consists of all the design intent information assembled to date in a project. The completed document includes:

- Design Intent Narrative (the goals consisting of Design Objectives);
- Design Concepts (design features that will meet the goal);
- Performance Metrics associated with each Design Concept (criteria to verify that the goal was met);
- Assessment documentation verifying system performance (documentation of performance).

The Design Intent Tool provides a single location where all of the above information can be compiled, stored and transmitted throughout the building delivery process. The tool will provide written reports with various combinations of the above components.

The programming report, plans and specifications are not a bound part of the Design Intent Document, but are included by reference along with other supporting materials such as energy simulations, environmental studies, etc.

Initially the Design Intent Document consists only of the Design Intent Narrative, which is a compilation of the issues and criteria important to the owner, (Design Objectives). Later, the designers take the initial Design Intent Narrative and add Design Concepts to each Design Objective, which describe how the Design Objective will be met. Performance Metrics are then added to the Design Concept. The owner and design team examine the Design Objectives, Concepts and their Performance Metrics for application and updating as design progresses. Design Objectives are likely to remain essentially unchanged. Design Concepts will go through some iteration before finalizing. Updated information is then forwarded to construction and commissioning personnel for their reference, and updated again as more data becomes available and as changes in the building's design occur. After construction, an as-built set of Performance Metrics is made available to facility management personnel for reference during O&M activities and updating as changes to the building occur over time. The Design Intent Document archives information from planning through occupancy, supporting design, construction, operational and renovation decisions throughout the building's life.

The Design Intent Document is organized at the highest level by Design Areas, such as lighting, heating and air conditioning, ventilation, energy efficiency, etc. Within each Design Area are Design Objective Categories. For example, in the Design Area of Lighting, some of the Design Objective Categories may be Codes and Standards used, Ambient Lighting, Daylighting, Exterior Lighting, etc. Within each Design Objective Category, a single Design Objective statement is developed which documents the issues and desires the owners and planners have for the given category.

For each Design Objective, one or more Design Concepts are developed which describe how the design will meet the Design Objective, including rationale. Later, for each Design Concept, one or more Performance Metrics are developed which give quantitative criteria and targets to use for verifying that the Design Concept was properly incorporated into the design documents and actual constructed building. Finally, a record is made of the actual verification of the installed operation and performance of the Design Concept and Objective in Assessment forms.

The following provides an outline of the Design Intent Document structure, which is also the structure within this tool:

Design Area 1

Design Objective Category 1

Design Objective (the goal)

Design Concept 1 (design features that will meet the goal)

Performance Metric 1 (criteria to verify that the goal was met)

Assessment record (documentation of performance)

Performance Metric 2....

Assessment record

Design Concept 2...

Performance Metric 1

Assessment record

Performance Metric 2

Assessment record

Design Objective Category 2.....

Repeat.....

Design Area 2

Repeat.....

Design Intent Narrative

The narrative contains a description of the owner's ideas, concepts, and performance criteria that delineate the anticipated building performance. The narrative is a product of the programming and sometimes the conceptual design phase of the project. It provides the design team with criteria that guide the entire design process. In this tool, the Design Intent Narrative consists of a compilation of the Design Objectives. The Design Intent Narrative is organized in the same manner as the Design Intent Document—from high level Design Areas to Design Objectives within Design Objective Categories. The Design Intent Narrative is provided to the designer who then proceeds with developing Design Concepts describing how they intend to meet each Design Objective.

Design Basis

The Design Basis is a collection of documents that describes the components, systems, conditions, and methods chosen to meet Design Objectives recorded in the Design Intent Narrative. The full Design Basis is a detailed description of technical criteria that provides the basis for the construction bid documents particularly the plans and specifications. A few of the most salient parts of the Design Basis may be included in the Design Concepts of the Design Intent Document, such as a listing of the codes and standards that are being met or exceeded in the design, as well as the calculations and analytical design tools used to make important design decisions. The Design Intent Tool does not develop the full Design Basis for a project. However, the compilation of all the Design Concepts developed in the Design Intent Tool will provide an abbreviated Design Basis.

Design Objectives

Design Objectives typically form the basis of, or may originate from the owner's design program. They qualitatively describe concepts, features and requirements that are considered important to the owner, and collectively constitute the initial Design Intent Narrative. They provide the design team with criteria that guides the entire design process. The Objective statement may discuss more than one concept, feature or requirement. Each Design Objective statement is associated with a Design Objective Category (Codes and Standards, Ambient Lighting, Daylighting, etc.). Related Design Objective Categories are grouped under a Design Area (Lighting, Right Sizing, O&M, Building Automation, etc.). In practice, while these objectives may be given considerable thought during the planning and design process, they are seldom clearly documented. Additionally, sharing design objectives either amongst design team members or with

commissioning personnel, operations and maintenance (O & M) personnel, and occupants is not typical. Establishing Design Objectives early and organizing and documenting them in the Design Intent clarifies objectives for all stakeholders.

An example of a Design Objective under the *Lighting* Design Area and *Daylighting* Design Objective Category is: “*As much light as possible will come from natural light, without excessive glare or heat. Use of conventional lights will be minimized.*”

Design Concepts

Design Concepts are concise descriptions of how the designer intends to meet each Design Objective, including appropriate rationale. They should include a listing of occupancy requirements and assumptions, indoor environmental quality objectives; project budget limitations, applicable codes, standards and policies, and a list of the analytical design tools used to make important design decisions, with reference to other documents where full calculations are held. For example, did the designer use rules of thumb, hand calculations or a computer tool to size the ducting, and did the designer use a textual guideline and hand calculations to estimate light levels from daylighting features or did they use a specific computer simulation program?

The Design Concepts may add more specific levels of performance than were found in the Design Objectives and may include design approach and a record and rationale of concepts considered, but rejected. Design Concepts are project design goals and descriptions of qualitative features to be incorporated into a building. Objectives can range from issues that deal with how a space will be made light, to how efficient a chiller will be.

In the Design Intent Tool, there may be multiple Design Concepts for any given Design Objective. For Design Objectives that require more than one element to accomplish, list multiple related elements in a single Design Concept statement, or use multiple separate Design Concepts.

An example of three Design Concepts (DC) under the *Lighting* Design Area and *Daylighting* Design Objective Category are given below for one Design Objective (DO).

DO-1: As much light as possible will come from natural light, without excessive glare or heat. Use of conventional lights will be minimized.

DC-1: Exterior walls will have a higher than normal glazing fraction to take advantage of daylighting. Glazing will be selected to give a reasonable compromise between shading coefficient and light transmittance by using Low-E high performance double-pane glass. Light shelves were evaluated and not considered cost-effective, because of the requirement to increase the ceiling height by one foot. Skylights and roof monitors were not evaluated.

DC-2: Tall deciduous trees will be provided to provide further shading on the lower level. Manually operable window shades will be provided. Motorized shades were not evaluated.

DC-3: Light fixtures in open areas adjacent to exterior windowed walls shall be provided with continuous dimming controls that will respond to light contributed by the windows and dim the lights accordingly.

Performance Metrics

Performance Metrics are quantitative goals for a building, system or component. Design Objectives and Design Concepts are verified to have been achieved by evaluating performance against Performance Metrics.

Metrics may also provide additional detail to Design Concepts not fully developed. Performance Metrics should be practical, verifiable, within the scope of the project budget, and the level of accuracy and rigor required by the metric should be appropriate for the risks the owner assumes when performance is not met. One or more metrics may be defined for any given Design Concept. In many instances, a complex Design

Concept can only be verified by multiple Performance Metrics, Metrics, for a common Design Concept, that require verification at different times or by different parties should be separated into unique Performance Metrics to ease tracking.

A guiding principle in defining a Performance Metric is to identify a critical variable that measures, reflects, or influences the performance objective to be substantiated. To be useful across a building's life-cycle, each metric must also be capable of being either predicted, measured at various stages of the project so that the achievement of each objective can be evaluated.

The following are examples of Performance Metrics (PM) for the Daylighting Design Concepts (DC) described in the Design Concepts definition:

DO-1: As much light as possible will come from natural light, without excessive glare or heat. Use of conventional lights will be minimized.

DC-1: Exterior walls will have a higher than normal glazing fraction to take advantage of daylighting. Glazing will be selected to give a reasonable compromise between shading coefficient and light transmittance by using Low-E high performance double-pane glass. Light shelves were evaluated using hand calculations and not considered cost-effective, because of the requirement to increase the ceiling height by one foot. Skylights and roof monitors were not evaluated.

PM-1: North and south exterior walls will have at least 30% glass. East and west sides will have at least 20% glass. All glass will be 2-pane, Low E. North glass will use glass with a shading coefficient of 0.35, south SC of 0.30, east and west SC of 0.28.

DC-2: Tall deciduous trees will be provided to provide further shading on the lower level. Manually operable window shades will be provided. Motorized shades were not evaluated.

PM-1: 14 ft sugar maple trees will be strategically planted 20-40 ft from the building—10 on the south, 6 on the east and 8 on the west.

PM-2: All but north glass will have interior operable vertical blinds to control heat and glare..

DC-3: Light fixtures in open areas adjacent to exterior windowed walls shall be provided with continuous dimming controls that will respond to light contributed by the windows and dim the lights accordingly.

PM-1: Light levels during a sunny day, intermittent sunshine, overcast and at night will be maintained to a minimum of 30-40 fc at the 30" work plane without task lights, at the lowest light fixture power output possible down to 20% of full output, and without abrupt changes in light output from the fixtures.

PM-2: 50% of the lighting energy for the daylit zones, during daylight hours, comes from daylight. (this was calculated using lighting design handbook methods)

Assessment Record

The Assessment Record records the verification that issues and features have been included in the design and are installed and operating as intended. This occurs throughout the design and construction process. For example, consider the Design Concept developed in pre-or early design of *Light fixtures in open areas adjacent to exterior windowed walls shall be provided with continuous dimming controls that will respond to light contributed by the windows and dim the lights accordingly*, with its associated Performance Metric of, *Light levels during a sunny day, intermittent sunshine, overcast and at night will be maintained to a minimum of 30-40 fc at the 30" work plane without task lights, at the lowest light fixture power output possible down to 20% of full output, and without abrupt changes in light output from the fixtures.*

These Concepts and Metrics are tracked at strategic points during design (conceptual design, design development; construction documents phases). This ensures that the desired objectives of the owner and the features committed by the designer are actually incorporated into the design and specifications. Later,

construction submittals may be reviewed and installations inspected to see that the contractor is providing and installing a product meeting the criteria. Finally, functional testing on the system to verify actual performance against the Performance Metrics is completed. All these verifications along the way are recorded in the Assessment Record of the Design Intent Tool.

Design Intent Process

The process to develop a project's Design Intent Document is a team effort. As many stakeholders as possible, need to be consulted to develop a facility's Design Intent including building owner(s), planners, occupants, design team members, facility operator(s), construction manager, and commissioning personnel.

Developing a Design Intent Document follows five general steps:

1. Develop Design Objectives and the Design Narrative. Develop and compile all of the owner's anticipated Design Objectives in a narrative, prose format to direct the A/E firm's design efforts. This is developed by the owner with or without A/E assistance. These Design Objectives are compiled under previously determined Design Objective Categories, which are grouped under Design Areas. The compiled Design Objectives become the Design Narrative.

Attain approval of the initial Design Intent Narrative from all stakeholders including design team members, owners, users, and facility personnel. A/E may also provide input to the Design Objectives.

2. Develop Design Concepts. Develop Design Concepts appropriate for issues in each Design Objective. Design Concept proposals are developed by the design team and approved by the owner and other stakeholders they may designate. The owner may already have specific requests or ideas as to what the Design Concepts should be for given Design Objectives.

3. Develop Performance Metrics. For each Design Concept, develop appropriate Performance Metrics to substantiate that the Design Objective and Concept have been incorporated into the design documents and actual constructed building. This effort is primarily the responsibility of the designers with input and approval from the commissioning provider, facility owner and users.

4. Keep an Assessment Record. The final step is to assess and track the verification of each Performance Metric. The Design Intent Tool provides assessment forms to do this.

The Design Intent process is intended to last across a building's life-cycle. Initial documentation is developed during Design Intent development. Changes are archived at each milestone in the project, not only throughout the design phase, but also during construction and commissioning. Alterations to a facility's Design Intent because of design changes, occupancy, operation, or renovation changes should be incorporated. The full value of maintaining this documentation will be realized when the Design Intent Tool is continuously referenced as a guide to decision-making, and as a tool for evaluating the ongoing performance of a facility.

Maintaining and Modifying the Design Intent Document

To be both useful and used, Design Intent information is recorded as it evolves, as Design Objectives and Design Concepts are identified and their Performance Metrics are established and modified. The initial design intent is likely to change through the design, construction and occupancy phases of the building's life, as use, occupancy and spaces are changed and modified. The Design Intent Tool provides a central location and method to capture changing information as it happens and then to store and transmit it to the next user.